

FEDERAL AVIATION AGENCY
Washington 25, D.C.
TECHNICAL STANDARD ORDER
Regulations of the Administrator
Part 514

Subject: AIRBORNE ILS LOCALIZER RECEIVING EQUIPMENT OPERATING
WITHIN THE RADIO-FREQUENCY RANGE OF 108 - 112 MEGACYCLES

TSO-C36b

Technical Standards Orders for Aircraft Materials, Parts and Appliances

Part 514 which contains minimum performance standards and specifications for materials, parts, and appliances used in aircraft consists of two subparts. Subpart A contains the general requirements applicable to all Technical Standard Orders. Subpart B contains the technical standards and specifications to which a particular product must conform.

ANY TECHNICAL STANDARD ORDER MAY BE OBTAINED BY SENDING A REQUEST TO FAA, WASHINGTON 25, D.C.

Subpart A—GENERAL

§ 514.0 Definition of terms.

As used in this part:

(a) "Administrator" means the Administrator of the Federal Aviation Agency or any person to whom he has delegated his authority in the matter concerned.

(b) "FAA" means Federal Aviation Agency.

(c) "Manufacturer" means a person who controls the design and quality of an article produced under the TSO system, including all parts thereof and processes and services related thereto obtained from outside sources.

(d) "Article" means the materials, parts, or appliances for which approval is required under the Civil Air Regulations for use on civil aircraft.

§ 514.1 Basis and purpose.

(a) *Basis.* Section 601 of the Federal Aviation Act of 1958, and §§ 3.18, 4a.31, 4b.18, 5.18, 6.18, 7.18, 10.21, 13.18, and 14.18 of this title (Civil Air Regulations).

(b) *Purpose.* (1) This part prescribes in individual Technical Standard Orders the minimum performance and quality control standards for FAA approval of specified articles used on civil aircraft,¹ and prescribes the methods by which the manufacturer of such articles shall show compliance with such standards in order to obtain authorization for the use of the articles on civil aircraft.

(2) The performance standards set forth in the individual Technical Standard Orders are those standards found necessary by the Administrator to assure that the particular article when used on civil aircraft will operate satisfactorily, or accomplish satisfactorily its in-

tended purpose under specified conditions.

§ 514.2 TSO authorization.

(a) *Privileges.* No person shall identify an article with a TSO marking unless he holds a TSO authorization and the article meets the applicable TSO standards prescribed in this part.

(b) *Letters of acceptance issued prior to July 1, 1962.* An FAA letter of acceptance of a statement of conformance issued for an article prior to July 1, 1962, is an authorization within the meaning of this part and the holder thereof may continue to manufacture such article without obtaining an additional TSO authorization, but shall comply with the requirements of § 514.3 through § 514.10.

(c) *Application.* The manufacturer or his duly authorized representative shall submit an application for a TSO authorization together with the following documents (See Appendix A of this subpart for sample application) to the Chief, Engineering and Manufacturing Branch, Flight Standards Division, in the region in which the manufacturer is located.²

(1) A statement of conformance certifying that the applicant has complied with the provisions of Subpart A and the article meets the applicable performance standards established in Subpart B of this part (See Appendix B of this subpart for sample statement of conformance);

(2) Copies of the technical data required in the performance standards set forth in Subpart B of this part for the particular article;

(3) A description of his quality control system in the detail specified in § 1.36 of this title (Civil Air Regulations). In complying with

this provision the manufacturer may refer to current quality control data filed with the Agency, as a part of a previous application.

NOTE: When a series of minor changes in accordance with § 514.5 is anticipated, the manufacturer may set forth in his application the basic model numbered article with open brackets after it to denote that suffix change letters will be added from time-to-time e.g., Model No. 100 ().

(d) *Issuance.* (1) Upon receipt of the application and adequate supporting documents specified in paragraph (c) of this section to substantiate the manufacturer's statement of conformance with the requirements of this part and his ability to produce duplicate articles in accordance with the provisions of this part, the applicant will be given an authorization to identify his article with the applicable TSO marking.

(2) If the application is deficient in respect to any requirements, the applicant shall, upon request by the Chief, Engineering and Manufacturing Branch, submit such additional information as may be necessary to show compliance with such requirements. Upon the failure of the applicant to submit such additional information within 30 days after the date of the request therefor, his application will be denied and he will be so notified by the Chief, Engineering and Manufacturing Branch.

NOTE: The applicant will be issued an authorization or notified of the denial of his application within 30 days after the date of receipt of such application or, in the event that additional information has been requested, within 30 days after the date of receipt of such additional information.

¹ Articles may also be approved and manufactured for use on civil aircraft as a part of the type design of a type certificate for an aircraft engine or propeller.

² Regional Offices are located at New York, Atlanta, Kansas City, Fort Worth, Los Angeles, Anchorage.

§ 514.3 Conditions on authorizations.

The manufacturer of an article under an authorization issued under the provisions of this part shall—

(a) Manufacture such article in accordance with the requirements of Subpart A and the performance standards contained in the applicable TSO of Subpart B of this part;

(b) Conduct the required tests and inspections, and establish and maintain a quality control system adequate to assure that such article, as manufactured, meets the requirements of paragraph (a) of this section and is in a condition for safe operation;

(c) Prepare and maintain for each type or model of such article a current file of complete technical data and records in accordance with § 514.6; and

(d) Permanently and legibly mark each such article with the following information:

(1) Name and address of the manufacturer,

(2) Equipment name, or type or model designation,

(3) Weight to the nearest tenth of a pound,

(4) Serial number and/or date of manufacturer, and

(5) Applicable Technical Standard Order (TSO) number.

§ 514.4 Deviations.

Approval for a deviation from the performance standards established in Subpart B may be obtained only if the standard or standards for which deviation is requested are compensated for by factors or design features which provide an equivalent level of safety. A request for such approval together with the pertinent data shall be submitted by the manufacturer to the Chief, Engineering and Manufacturing Branch of the Region in which the applicant is located.

§ 514.5 Design changes.

(a) *By Manufacturer*—(1) *Minor changes.* The manufacturer of an article under an authorization issued pursuant to the provisions of this part may make minor design changes to the article without further approval by the FAA. In such case the changed article shall retain the original model number and the manufacturer shall forward to the Chief, Engineering and Manufacturing Branch such revised data as may be necessary for compliance with § 514.2(c).

(2) *Major changes.* If the changes to the article are so extensive as to require a substantially complete investigation to determine compliance with the performance standards established in Subpart B, the manufacturer shall assign a new type or model designation to the

article and submit a new application in accordance with the provisions of § 514.2(c).

(b) *By persons other than the manufacturer.* Design changes to an article by a person other than the manufacturer who submitted the statement of conformance for such article are not eligible for approval under this part, unless such person is a manufacturer as defined in § 514.0 and applies for authorization under § 514.2(c).

NOTE: Persons other than a manufacturer may obtain approval for design changes to a product manufactured under a TSO pursuant to the provisions of Part 18 or the applicable airworthiness regulations.

§ 514.6 Retention of data and records.

(a) A manufacturer holding an authorization issued pursuant to the provisions of this part shall, for all articles manufactured under such authorization on and after July 1, 1962, maintain and keep at his factory:

(1) A complete and current technical data file for each type or model of article which shall include the design drawings and specifications. This technical data shall be retained for the duration of his operation under the provisions of this part.

(2) Complete and current inspection records to show that all inspections and tests required to ensure compliance with this part have been properly accomplished and documented. These records shall be retained for at least two years.

(b) The data specified in paragraph (a)(1) of this section shall be identified and copies transferred to the FAA for record purposes in the event the manufacturer terminates his business or no longer operates under the provisions of this part.

§ 514.7 Inspection and examination of data, articles or manufacturing facilities.

The manufacturer shall, upon request, permit an authorized representative of the FAA to inspect any article manufactured pursuant to this part, and to observe the quality control inspections and tests and examine the manufacturing facilities and technical data files for such article.

§ 514.8 Service difficulties.

Whenever the investigation of an accident or a service difficulty report shows an unsafe feature or characteristic caused by a defect in design or manufacture of an article, the manufacturer shall upon the request of the Chief, Engineering and Manufacturing Branch, report the results of his investigation and the action, if any, taken or proposed by him to correct the defect in design

or manufacture (e.g., service bulletin, design changes, etc.). If the defect requires a design change or other action to correct the unsafe feature or characteristic, the manufacturer shall submit to the Chief, Engineering and Manufacturing Branch, the data necessary for the issuance of an airworthiness directive containing the appropriate corrective action.

§ 514.9 Noncompliance.

Whenever the Administrator finds that a manufacturer holding an authorization issued pursuant to the provisions of this part has identified an article by a TSO marking and that such article does not meet the applicable performance standards of this part, the Administrator may, upon notice thereof to the manufacturer, withdraw the manufacturer's authorization and, where necessary, prohibit any further certification or operation of a civil aircraft upon which such article is installed until appropriate corrective action is taken.

§ 514.10 Transferability and duration.

An authorization issued pursuant to the provisions of this part shall not be transferred and is effective until surrendered, or withdrawn, or otherwise terminated by the Administrator.

APPENDIX A SAMPLE APPLICATION FOR TSO AUTHORIZATION

(Date)

(Addressed to: Chief, Engineering and Manufacturing Branch, Federal Aviation Agency, Region.)

Application is hereby made for authorization to use the Technical Standard Order procedures.

Enclosed is a statement of conformance for the article to be produced under TSO-C-----.

The required quality control data¹ are transmitted: (herewith) (under separate cover).

Signed -----

APPENDIX B SAMPLE STATEMENT OF CONFORMANCE

(Date)

(Addressed to: Chief, Engineering and Manufacturing Branch, Flight Standards Division, Federal Aviation Agency.)

The undersigned hereby certifies that the article listed below by model, type or part number has been tested and meets the performance standards of Technical Standard Order C----- . In addition, all other applicable provisions of Part 514 of the Regulations of the Administrator have been met.

The technical data required by the TSO in the quantity specified are transmitted: (herewith) (under separate cover).

Authorization to use TSO identification on this article is requested.

Signed -----

¹ Reference may be made to data already on file with the FAA.

§ 514.61 Airborne ILS localizer receiving equipment operating within the radio-frequency range of 108-112 megacycles—TSO-C36b.

(a) *Applicability.* (1) Minimum performance standards are hereby established for airborne ILS localizer receiving equipment which is to be used on civil aircraft of the United States engaged in air carrier operations. New models of airborne ILS localizer receiving equipment manufactured for use on civil air carrier aircraft on or after the effective date of this section shall meet the minimum performance standards contained in Federal Aviation Agency Standard entitled "Minimum Performance Standards for Airborne ILS Localizer Receiving Equipment",¹ dated June 15, 1962, and Radio Technical Commission for Aeronautics Paper 120-61/DO-108² entitled "Environmental Test Procedures Airborne Electronic Equipment", dated July 13, 1961, with the exceptions to these standards listed in subparagraph (2) of this paragraph.

(2) Radio Technical Commission for Aeronautics Paper 120-61/DO-108 outlines various test procedures which define the environmental extremes over which the equipment shall be designed to operate. Some test procedures have categories established and some do not. Where categories are established, only equipment which qualifies under the

following categories, as specified in RTCA Paper 120-61/DO-108, is eligible under this order:

(i) Temperature-Altitude Test—Categories A, B, C, or D;

(ii) Humidity Test—Categories A or B;

(iii) Vibration Test—Categories A, B, C, D, E, or F;

(iv) Audio-Frequency Magnetic Field Susceptibility Test—Categories A or B;

(v) Radio-Frequency Susceptibility Test—Category A; and

(vi) Emission of Spurious Radio-Frequency Energy Test—Category A.

(b) *Marking.* (1) In addition to the markings specified in § 514.3(d), the equipment shall be marked to indicate the environmental extremes over which it has been designed to operate. There are seven environmental test procedures outlined in RTCA Paper 120-61/DO-108 which have categories established. These should be identified on the nameplate by the words "environmental categories" or, as abbreviated, "Env. Cat." followed by seven letters which identify the categories designated in RTCA Paper 120-61/DO-108. Reading from left to right, the category designations shall appear on the nameplate in the following order so that they may be readily identified:

(i) Temperature-Altitude Test Category;

(ii) Humidity Test Category;

(iii) Vibration Test Category;

(iv) Audio-Frequency Magnetic Field Susceptibility Test Category;

(v) Radio-Frequency Susceptibility Test Category;

(vi) Emission of Spurious Radio-Frequency Energy Test Category; and

(vii) Explosion Test.

(2) Equipment which meets the explosion test requirement shall be identified by the letter "E". Equipment which does not meet the explosion test requirement shall be identified by the letter "X". A typical nameplate identification would be as follows: Env. Cat. DABAAAX.

(3) In some cases such as under the Temperature-Altitude Test Category, a manufacturer may wish to substantiate his equipment under two categories. In this case, the nameplate shall be marked with both categories in the space designated for that category by placing one letter above the other in the following manner: Env. Cat. ^A_DABAAAX.

(4) Each major component of the equipment (antenna, power supply, etc.) shall be identified with at least the manufacturer's name, TSO number, and the environmental categories over which the equipment component is designed to operate.

(c) *Data requirements.* In accordance with the provisions of § 514.2 the manufacturer shall furnish to the Chief, Engineering and Manufacturing Branch, Flight Standards Division, Federal Aviation Agency, in the region in which the manufacturer is located, the following technical data:

(1) Six copies of the manufacturer's operating instructions and equipment limitations;

(2) Six copies of the installation procedures with applicable schematic drawings, wiring diagrams, and specifications, indicating any limitations, restrictions, or other conditions pertinent to installation; and

(3) One copy of the manufacturer's test report.

(d) *Effective date.* January 1, 1964.

¹ Copies may be obtained upon request addressed to Publishing and Graphics Division, Inquiry Section, HQ-440, Federal Aviation Agency, Washington, D.C. 20553

² Copies of this paper may be obtained from the RTCA Secretariat, Room 1072, T-5 Building, 16th & Constitution Avenue, N.W., Washington, D.C. 20553, at the cost of 75 cents per copy.

FEDERAL AVIATION AGENCY
WASHINGTON, D.C.

MINIMUM PERFORMANCE STANDARDS FOR
AIRBORNE ILS LOCALIZER RECEIVING EQUIPMENT

JUNE 15, 1962

TABLE OF CONTENTS

	<i>Page</i>
INTRODUCTION	v
1.0 GENERAL STANDARDS	1
1.1 Rating of Components	1
1.2 Operation of Controls	1
1.3 Effects of Test	1
1.4 Accessibility of Controls	1
1.5 Deviation Indicator Deflection Range	1
2.0 MINIMUM PERFORMANCE STANDARDS UNDER STANDARD TEST CONDITIONS	1
2.1 Voltage Standing Wave Ratio (Receiver)	1
2.2 Voltage Standing Wave Ratio (Antenna)	1
2.3 Centering Characteristic	1
2.4 Sensitivity and Deflection Characteristic	1
2.5 Deflection Linearity	1
2.6 Selectivity	1
2.7 Spurious Response	2
2.8 Cross Modulation	2
2.9 Alarm Signal	2
2.10 Emission of Radio-Frequency Energy	2
2.11 Damping Characteristic	3
2.12 Power Source Frequency Variation	3
2.13 Deviation Indicator Stability with Change in Frequency of 90 and 150 c.p.s. Signals	3
2.14 Deviation Indicator Sensitivity Adjustment Range	3
2.15 Operation of Two Localizer Receivers from the Same Antenna	3
2.16 Audio-Frequency Response	3
2.17 Audio Output Regulation and Distortion	3
2.18 Percentage Modulation Characteristic	3
3.0 MINIMUM PERFORMANCE STANDARDS UNDER ENVIRONMENTAL TEST CONDITIONS	3
3.1 Temperature-Altitude Test	4
3.2 Humidity Test	4
3.3 Shock Test	4
3.4 Vibration Test	4
3.5 Temperature Variation Test	4
3.6 Low Voltage Test	5
3.7 Conducted Voltage Transients Tests	5
3.8 Conducted Audio-Frequency Susceptibility Test	5
3.9 Audio-Frequency Magnetic Field Susceptibility Test	5
3.10 Radio-Frequency Susceptibility Test (Radiated and Conducted)	5
3.11 Explosion Test (When Required)	5

TABLE OF CONTENTS—Continued

	<i>Page</i>
APPENDIX A	7
1.0 TEST CONDITIONS	8
2.0 TEST PROCEDURES	8
2.1 Voltage Standing Wave Ratio (Receiver)	8
2.2 Voltage Standing Wave Ratio (Antenna)	8
2.3 Centering Characteristic	8
2.4 Sensitivity and Deflection Characteristic	8
2.5 Deflection Linearity	8
2.6 Selectivity	9
2.7 Spurious Response	9
2.8 Cross Modulation	9
2.9 Alarm Signal	9
2.10 Emission of Radio-Frequency Energy	9
2.11 Damping Characteristics	9
2.12 Power Source Frequency Variation	10
2.13 Deviation Indicator Stability with Change in Frequency of 90 and 150 c.p.s. ..	10
2.14 Deviation Indicator Sensitivity Adjustment Range	10
2.15 Operation of Two Localizer Receivers from the Same Antenna	10
2.16 Audio-Frequency Response	11
2.17 Audio Output Regulation and Distortion	11
2.18 Percentage Modulation Characteristic	11
FIGURE 1	11

INTRODUCTION

This document sets forth minimum performance standards for airborne ILS localizer receiving equipment.

Compliance with these standards by manufacturers and users is required as a means of assuring that the equipment will satisfactorily perform its intended function.

Inasmuch as the measured values of radio equipment performance characteristics may be a function of the method of measurement, standard test conditions and methods of test are also included in this document.

The word "equipment" as used herein includes all of the components or units necessary (as determined by the equipment manufacturer) for the equipment to perform properly its intended function. For example, an airborne ILS localizer receiving "equipment" may include an antenna, a receiver unit, a control box, a power supply, a shock mount, etc. In the case of this example, all of the foregoing components or units comprise the "equipment". It should not be inferred from this example, however, that every airborne ILS localizer receiving equipment will necessarily include all of the foregoing components. This will depend on the design used by the equipment manufacturer.

Acknowledgment is hereby given to the Radio Technical Commission for Aeronautics (RTCA), a report of which (Paper 89-54/DO-59 dated July 15, 1954) is the basic source of the standards contained herein.

MINIMUM PERFORMANCE STANDARDS

AIRBORNE ILS LOCALIZER RECEIVING EQUIPMENT

1.0 GENERAL STANDARDS

1.1 Rating of Components. The equipment shall not incorporate in its design a component of such rating that, when the equipment is operated throughout the range of the specified environmental tests, the rating established by the manufacturer of the component is exceeded. For electron tubes, the continuous commercial service rating of the tube manufacturer is applicable except for the heaters and filaments. The voltage applied to the heaters and filaments of electron tubes shall be within 5% of the manufacturer's rating when the equipment is operated under standard test conditions. When the heaters and filaments are connected in series, the 5% tolerance shall apply to the sum of their voltage ratings.

1.2 Operation of Controls. The design of the equipment shall be such that the controls intended for use during flight cannot be operated in any possible position combination or sequence which would result in a condition whose presence or continuation would be detrimental to the reliability of the equipment.

1.3 Effects of Test. The design of the equipment shall be such that the application of the specified tests produces no discernible condition which would be detrimental to the reliability of equipment manufactured in accordance with such design.

1.4 Accessibility of Controls. Controls which are not normally adjusted in flight shall not be readily accessible to flight personnel.

1.5 Deviation Indicator Deflection Range. The deviation indicator shall be capable of deflecting at least five-eighths of an inch on both sides of its center zero position. In the case of "cross pointer" type instruments, the reference deflection line shall be the centered glide slope deviation indicator needle. In the case of other type indicators, the reference deflection line shall be its scale.

2.0 MINIMUM PERFORMANCE STANDARDS UNDER STANDARD TEST CONDITIONS

The test procedures applicable to a determination of the performance of airborne ILS localizer receiving equipment under standard test conditions are set forth in Appendix "A" of this report.

2.1 Voltage Standing Wave Ratio (Receiver). When the receiver is designed for use with a transmission line, the voltage standing wave ratio on the transmission line shall not exceed a value of 10 over the RF frequency range from 108.0 mc. to 112.0 mc.

2.2 Voltage Standing Wave Ratio (Antenna). When the antenna to be used with the receiver is designed for use with a transmission line, the voltage standing wave ratio on the transmission line shall not exceed a value of 6 over the RF frequency range from 108.0 mc. to 112.0 mc.

2.3 Centering Characteristic. The deviation indication shall not depart from the centering position by more than 10% of the standard deflection when the level of a standard localizer centering signal is varied over the range of 40 to 20,000 μ v.

2.4 Sensitivity and Deflection Characteristic. The deviation indicator deflection shall remain within a range equal to 20% of the deflection at 1,000 μ v input when the level of a standard localizer deviation signal is varied over the range of 40 to 20,000 μ v.

2.5 Deflection Linearity. Over the deflection range of the deviation indicator, the amount of deflection shall be within 10% of being proportional to the difference in depth of modulation¹ of the 90 and 150 c.p.s. signals, or the amount of deflection shall be within 10% of standard deflection of being proportional to the difference in depth of modulation, whichever is greater. Additionally, as the difference in depth of modulation is increased beyond that producing maximum deflection to a value of .4 ddm, the deflection shall not be less than its maximum value. These standards shall be met over the range of signal input level from 40 to 20,000 μ v.

2.6 Selectivity:

a. Receivers designed for selection of frequency channels in discrete increments.

- (1) The level of an input signal required to produce a given output shall not vary more than 6 db over the input signal frequency range—

From:

The assigned channel frequency -2.5 kc., -0.005% of the assigned channel frequency, minus the maximum positive departure of center response frequency² from the assigned channel frequency under the Temperature Variation Test;

¹ Difference in depth of modulation (ddm) is the percentage modulation depth of the larger signal minus the percentage modulation depth of the smaller signal divided by 100.

² Center response frequency is the frequency midway between the two frequencies at which the receiver response, as shown by the selectivity curve, is 6 db down from maximum.

To:

The assigned channel frequency ± 2.5 kc., $\pm 0.005\%$ of the assigned channel frequency, plus the maximum negative departure of center response frequency from the assigned channel frequency under the Temperature Variation Test.

NOTE.—Airborne receivers in which the nose bandwidth of the selectivity characteristic is at least as broad as that defined in this standard have been demonstrated to provide adequate sensitivity and deviation indicator deflection characteristics in aircraft operations. A nose bandwidth less than that set forth above may be used provided that the standards in paragraphs 2.3, *Centering Characteristic*; 2.4, *Sensitivity and Deflection Characteristic*; and 2.5, *Deflection Linearity* are met for all localizer signal carrier frequencies.

- (2) The level of an input signal required to produce a given output shall be at least 60 db greater than the level required to produce the given output at the frequency of maximum response—
At a frequency equal to:

The assigned channel frequency ± 100 kc., $\pm 0.005\%$ of the assigned channel frequency minus the maximum positive departure of center response frequency from the assigned channel frequency occurring under the Temperature Variation Test;

And at a frequency equal to:

The assigned channel frequency ± 100 kc., $\pm 0.005\%$ of the assigned channel frequency plus the maximum negative departure of center response frequency from the assigned channel frequency occurring under the Temperature Variation Test.

- b. Receivers in which the resonant frequency changes continuously when tuning from one channel to another.

- (1) The level of an input signal required to produce a given output shall not vary more than 6 db over the input signal frequency range from at least 20 kc. below center response frequency to at least 20 kc. above center response frequency.
- (2) The level of an input signal required to produce a given output at frequencies of plus and minus 160 kc. from the center response frequency shall be at least 60 db greater than the level required to produce the same output at the frequency of maximum response.

NOTE.—As of the date of this report, the spacing between VOR/LOC frequency channels within the band 108.0 to 112.0 mc. is 100 kc. Experience has shown that the criteria used to select frequencies for VOR/LOC facilities permits tunable receivers, having the selectivity characteristics set forth above, to

be adjusted to provide satisfactory reception at distances not exceeding 25 nautical miles from the facility and at altitudes not exceeding 2,000 feet above the facility. When it is intended that satisfactory receiver operation be obtained at greater distances and at higher altitudes, additional selectivity is required to suppress signals from VOR facilities 100 kc. removed from the desired signal.

2.7 Spurious Response. The response of the receiver shall be at least 60 db below the response at center response frequency when an input signal modulated 30% at 150 c.p.s. is varied over the frequency range of 0.190 mc. to 1,500 mc., excluding the frequency band 107.8 mc. to 112.2 mc.

2.8 Cross Modulation. With the simultaneous application of a standard localizer centering signal at maximum response frequency (desired signal) and a signal consisting of an RF carrier amplitude modulated 30% at 150 c.p.s. at other than maximum response frequency (undesired signal), the alarm signaling device shall indicate a usable signal, and the deviation indication shall not depart from its centered position due to cross modulation by more than 10% of standard deflection under the following conditions:

Level of Desired Signal	Level of Undesired Signal	Frequency Range Over Which Undesired Signal is Varied
200 μ v	10,000 μ v	107.0 mc.—112.0 mc., excluding the band
1,000 μ v	20,000 μ v	within 200 kc. of the desired signal frequency

2.9 Alarm Signal. An alarm signaling device shall be provided. The device shall:

- Be plainly visible in the absence of an RF signal. Be plainly visible in the absence of 90 and 150 c.p.s. modulation on a 1,000 μ v carrier at center response frequency.
- At least begin to appear when the percentage modulation of the 90 and 150 c.p.s. signals of a standard localizer centering signal is reduced to 10% of each and when the percentage modulation of either the 90 or 150 c.p.s. signal is zero and the other 20%.
- At least begin to appear when the level of a standard localizer deviation signal produces 50% of standard deflection of the deviation indicator.
- Be energized and its indicator off or out of sight when the level of a standard localizer test signal is varied over the range of at least 40 to 20,000 μ v.

2.10 Emission of Radio-Frequency Energy. The level of conducted and radiated spurious radio-frequency energy emitted by the equipment shall not exceed those levels specified in Appendix A to RTCA Paper 120-61/DO-108—"Environmental Test Procedures—Airborne Electronic Equipment", dated July 13, 1961, for the aircraft category for which the equipment is designed.

2.11 Damping Characteristic. When a standard localizer test signal of 1,000 μv is abruptly changed from a standard localizer centering signal to a standard localizer deviation signal, the deviation indicator shall, in not more than two seconds, move to the point which is removed from the final stabilized position of the indicator by a distance no more than 10% of standard deflection. The initial "overshoot" of the indicator shall not exceed 2% of standard deflection.

NOTE.—The amount of indicator damping required for satisfactory service operation of a localizer receiver may exceed the amount specified above. The additional damping may be provided through adjustment within the receiver or through external damping means.

2.12 Power Source Frequency Variation. When the receiver is designed for operation from an a.c. power source of variable frequency and the frequency is slowly varied through the range for which the receiver is designed, the deviation indication shall not vary more than 5% of standard deflection in the presence of a standard localizer centering signal of 1,000 μv .

2.13 Deviation Indicator Stability with Change in Frequency of 90 and 150 c.p.s. Signals.

- a. The deviation indicator shall not change from its centered position by more than 10% of standard deflection when the frequency of the modulation signals of a 1,000 μv standard localizer centering signal is simultaneously varied over the range from 97.5% to 102.5% of 90 and 150 c.p.s.
- b. The deviation indicator shall not depart from standard deflection by more than 15% of standard deflection when the frequency of the modulation signals of a 1,000 μv standard localizer deviation signal is simultaneously varied over the range from 97.5% to 102.5% of 90 and 150 c.p.s.

2.14 Deviation Indicator Sensitivity Adjustment Range. Means shall be provided for the service adjustment of the deviation indicator sensitivity over the range of at least from 0.4 to 0.8 of full deflection when the input signal is a standard localizer deviation signal of 1,000 μv . At all sensitivity adjustments over the range of 0.4 to 0.8 of full deflection, the standards of paragraphs 2.3, 2.4 and 2.5 shall be met except that, in this case, the deflection obtained with a standard localizer deviation signal of 1,000 μv at the particular deflection sensitivity setting shall be used instead of standard deflection.

NOTE.—Adjustment of deviation indicator deflection sensitivity may be accomplished by means of a variable control or by replacing circuit elements, such as resistors, with those having another value.

2.15 Operation of Two Localizer Receivers from the Same Antenna. (This standard is applicable to those receivers designed to operate from an antenna which also supplies signals to another receiver.) When the receiver is connected in accordance with the manufacturer's instructions to an antenna which also sup-

plies signals to another receiver and both receivers are operated in accordance with the manufacturer's instructions, the standards of all paragraphs 2.0 shall be met and, in addition, the deviation indication inaccuracies resulting from interaction between the two receivers when operated on the same RF frequency shall not exceed 5% of standard deflection. For the purpose of this standard, the junction of the two transmission lines connected to the receivers shall be considered the receiver input.

NOTE.—It is recognized that two receivers meeting this standard may interfere with one another on some combinations of channel settings. While it is desirable that two receivers so connected cannot interfere with one another at all channel setting combinations, the state of the art is such that it is impracticable to set forth an equipment standard in these terms. It is recommended that equipment manufacturers take cognizance of this and make a determined effort to reduce the number of channel setting combinations where interference might occur and to reduce the severity of the interference in those cases where it cannot be eliminated.

2.16 Audio-Frequency Response. The receiver audio output level shall not vary more than 9 db when the audio modulating frequency of a standard localizer audio signal is varied over the range of 350 to 2,500 c.p.s. The RF input level shall be held constant at a value producing an output signal plus noise-to-noise ratio of 25 db, and the output at 1,000 c.p.s. shall be not less than 90% of the rated output.

NOTE.—The above standard on audio frequency response defines a minimum acceptable performance in accordance with current practice. The equipment designer should be aware, however, that advances in air/ground communications system design may dictate a revision of this standard in the future.

2.17 Audio Output Regulation and Distortion. With an output load of 200% of design impedance and with an output load of 50% of design impedance, the combined distortion and noise in the receiver audio output shall not exceed 20% of the total output, and the output power level shall be within 2:1 of the level when the load is that for which the receiver is designed. This requirement shall be met over the RF input range of 40 to 20,000 μv and over the audio frequency range of 350 to 2,500 c.p.s.

2.18 Percentage Modulation Characteristic. The deviation indicator shall not depart from its centered position by more than 5% of standard deflection when a standard localizer audio signal is applied to the receiver input and the percentage modulation of the 90 and 150 c.p.s. signals is increased from 20% each to 25% each.

3.0 MINIMUM PERFORMANCE STANDARDS UNDER ENVIRONMENTAL TEST CONDITIONS

Unless otherwise specified, the test procedures applicable to a determination of the performance of this equipment under environmental test conditions are set forth in RTCA Paper 120-61/DO-108—"Environmental Test Procedures—Airborne Electronic Equipment", dated July 13, 1961.

3.1 Temperature—Altitude Test:

a. Low Temperature Test—When the equipment is subjected to this test:

- (1) The receiver sensitivity, as defined in paragraph k of Appendix A, shall be 80 μ v or better.
- (2) The deviation indicator deflection with a 1,000 μ v standard localizer *centering* signal shall not change from that obtained under standard test conditions by more than 15% of standard deflection.
- (3) The deviation indicator deflection with a 1,000 μ v standard localizer *deviation* signal shall not change from that obtained under standard test conditions by more than -30% to +40% of standard deflection.

b. High Temperature Test:

- (1) When the equipment is operated at the High Short-Time Operating Temperature:
 - (a) All mechanical devices shall operate satisfactorily.
 - (b) There shall be no evidence of materials, such as grease or potting and sealing compounds, exuding or dripping from the equipment.
- (2) When the equipment is operated at the High Operating Temperature:
 - (a) The receiver sensitivity as defined in paragraph k of Appendix A shall be 80 μ v or better.
 - (b) The deviation indicator deflection with a 1,000 μ v standard localizer *centering* signal shall not change from that obtained under standard test conditions by more than 15% standard deflection.
 - (c) The deviation indicator deflection with a 1,000 μ v standard localizer *deviation* signal shall not change from that obtained under standard test conditions by more than -30% to +40% of standard deflection.

c. Decompression Test (When Required). When the equipment is subjected to this test the performance requirements of paragraphs 2.3 and 2.4 shall be met.

d. Altitude Test. When the equipment is subjected to this test the performance requirements of paragraphs 2.3 and 2.4 shall be met.

3.2 Humidity Test—After subjection to humidity and

- a. Within 15 minutes from the time primary power is applied, the sensitivity shall be within 4:1 of that obtained under standard test conditions; the deviation indicator de-

flection, with a standard localizer centering signal of 1,000 μ v, shall not exceed 15% of standard deflection; and the deviation indicator deflection, with a standard localizer deviation signal of 1,000 μ v, shall not depart from standard deflection by more than 30% of standard deflection.

- b. Within four hours from the time primary power is applied, the sensitivity shall be within 1.25:1 or \pm μ v, whichever is greater, of that obtained under standard test conditions; the deviation indicator deflection, with a standard localizer centering signal of 1,000 μ v, shall not exceed 5% of standard deflection; and the deviation deflection, with a standard localizer deviation signal of 1,000 μ v, shall not depart from standard deflection by more than 10% of standard deflection.

3.3 Shock Test:

- a. Following the application of the Operational Shocks, the requirements of paragraphs 2.3 and 2.4 shall be met.
- b. Following the application of the Crash Safety Shocks, the equipment shall have remained in its mounting and no parts of the equipment or its mounting shall have become detached and free of the shock test table or of the equipment under test.¹

3.4 Vibration Test. When subjected to this test:

- a. The deviation indicator shall not depart from its centered position by more than 10% of standard deflection when a standard localizer centering signal is applied to the receiver input and the equipment is subjected to the vibration test.
- b. The deviation indicator shall not depart from standard deflection by more than 20% of standard deflection when a standard localizer deviation signal is applied to the receiver input and the equipment is subjected to the vibration test.

3.5 Temperature Variation Test. When the equipment is subjected to the temperature variation test:

- a. The center response frequency of the receiver shall remain within:
 - (1) 12 kc. of the assigned channel frequency in the case of receivers designed to select the assigned frequency channels in discrete increments.
 - (2) 0.1% of the assigned channel frequency in the case of continuously tunable receivers.

¹ The application of this test and that required by paragraph 3.6c. may result in damage to the equipment under test. Therefore, they may be conducted after the other tests are completed. Paragraph 1.3 does not apply.

- b. The deviation indicator deflection, with a 1,000 μ v standard localizer *centering* signal, shall not change from that obtained under standard test conditions by more than 15% of standard deflection.
- c. The deviation indicator deflection, with a 1,000 μ v standard localizer *deviation* signal, shall not change from that obtained under standard test conditions by more than 30% of standard deflection.

NOTE.—In the case of continuously tunable receivers, the receiver shall meet the standards of paragraphs b. and c. when it is tuned to the center response frequency.

3.6 Low Voltage Test:

- a. When the primary power voltage(s) of d.c. operated equipment is 80% and when that of a.c. operated equipment is 87½% of standard test voltage(s), the equipment shall start and continue to operate electrically and mechanically. Degradation of performance is tolerable.
- b. The d.c. operated equipment shall operate satisfactorily within two (2) minutes upon returning the primary power voltage(s) to normal after the gradual reduction of the primary power voltage(s) from 80% to 50% of standard test voltage(s).
- c. The gradual reduction of the primary power voltage(s) of d.c. operated equipment from 50% to 0% of standard test voltage(s) shall

produce no evidence of the presence of fire or smoke.¹

3.7 Conducted Voltage Transients Tests:

- a. Following the Intermittent Transients Test, the requirements of paragraphs 2.3 and 2.4 shall be met.
- b. During the Repetitive Transients Test, the requirements of paragraphs 2.3 and 2.4 shall be met.

3.8 Conducted Audio-Frequency Susceptibility Test. When the equipment is subjected to this test the requirements of paragraphs 2.3 and 2.4 shall be met, excepting within the band of ± 100 kc. of the frequency to which the receiver is tuned.

3.9 Audio-Frequency Magnetic Field Susceptibility Test. When the equipment is subjected to this test, the requirements of paragraph 2.4 shall be met.

3.10 Radio-Frequency Susceptibility Test (Radiated and Conducted). When the equipment is subjected to this test, the requirements of paragraphs 2.3 and 2.4 shall be met.

3.11 Explosion Test (When Required). During the application of this test, the equipment shall not cause detonation of the explosive mixture within the test chamber.

¹ The application of this test and that required by paragraph 3.3b. may result in damage to the equipment under test. Therefore, they may be conducted after the other tests are completed. Paragraph 1.3 does not apply.

APPENDIX A

1.0 TEST CONDITIONS.

The following definitions of terms and conditions of test are applicable to the receiving equipment tests specified herein:

- a. *Power Input Voltage.* Unless otherwise specified, all tests shall be conducted with the power input voltage adjusted to design voltage $\pm 2\%$. The input voltage shall be measured at the receiver input terminals.

NOTE.—Design voltages in use as of the date of this report are 13.75 v d.c., 27.5 v d.c., and 115 v a.c.

- b. *Power Input Frequency:*

- (1) In the case of receivers designed for operation from an a.c. power source of essentially constant frequency (e.g., 400 c.p.s.), the input frequency shall be adjusted to design frequency $\pm 2\%$.

- (2) In the case of equipment designed for operation from an a.c. power source of variable frequency (e.g., 300 to 1,000 c.p.s.), unless otherwise specified, tests shall be conducted with the input frequency adjusted to within 5% of a selected frequency and within the range for which the equipment is designed.

- c. *Adjustment of Equipment.* The circuits of the equipment under test shall be properly aligned and otherwise adjusted in accordance with the manufacturer's recommended practices prior to the application of the specified tests.

- d. *Test Instrument Precautions.* Due precautions shall be taken during the conduct of the tests to prevent the introduction of errors resulting from the connection of headphones, voltmeters, oscilloscopes, and other test instrument across the input and output impedances of the equipment under test.

- e. *Ambient Conditions.* Unless otherwise specified, all tests shall be conducted under conditions of ambient room temperature, pressure, and humidity. However, the room temperature shall be not lower than 10° C.

- f. *Warmup Period.* Unless otherwise specified, all tests shall be conducted after a warmup period of not less than fifteen (15) minutes.

- g. *Connected Load.* Unless otherwise specified, all tests shall be performed with the equipment connected to loads having the impedance values for which it is designed.

- h. *RF Input Voltage.* The "RF input voltage" is defined as the "open circuit" voltage of the circuit connected to the receiver input. The circuit connected to the receiver input shall be the equivalent of the RF input voltage in series with an impedance having a resistance within 10% and a reactance of not more than 10% of the characteristic impedance of the transmission line for which the receiver is designed.

NOTE.—The RF input voltages specified herein are for the case of a receiver designed for a transmission line having a nominal characteristic impedance of 52 ohms. In the case of a receiver designed for a transmission line having a nominal characteristic impedance of other than 52 ohms, the RF input voltage values shall be computed according to the following equation:

$$E_2 = \sqrt{\frac{E_1^2 \times R_2}{52}}$$

Where E_2 is the RF input voltage to be used in the case of a receiver designed for a transmission line having a nominal characteristic impedance other than 52 ohms—

E_1 is the RF input voltage specified herein—

R_2 is the nominal characteristic impedance of the transmission line for which the receiver is designed.

- i. *Standard Test Signals.* Unless otherwise specified, the RF input signals shall be as follows:

- (1) *Standard Localizer Test Signal.* An RF carrier amplitude modulated simultaneously with 90 $\pm 3\%$ and 150 $\pm 3\%$ c.p.s. signals so that the sum of their separate modulation percentages equals 40 $\pm 2\%$.

- (2) *Standard Localizer Centering Signal.* A standard localizer test signal in which the difference in depth of modulation¹ of the 90 and 150 c.p.s. signals is less than 0.002 (0.1 db).

- (3) *Standard Localizer Deviation Signal.* A standard localizer test signal in which the difference in depth of modulation¹ of the 90 and 150 c.p.s. signals is 0.093 ± 0.002 (4 ± 0.1 db).

¹ Difference in depth of modulation (ddm) is the percentage modulation depth of the larger signal minus the percentage modulation depth of the smaller signal divided by 100.

- (4) *Standard Localizer Audio Signal.* A standard localizer test signal to which is added an audio signal amplitude modulating the carrier 30%.

- j. *Standard Deflection.* "Standard Deflection" shall be 0.6 of the center to full scale deflection of the deviation indicator. The receiver shall be adjusted to produce standard deflection when the input signal is a standard localizer deviation signal of 1,000 μ v.
- k. *Receiver Sensitivity.* The receiver sensitivity is the minimum level in microvolts of a standard localizer deviation signal required to produce simultaneously (1) a deflection of the deviation indicator of at least 60% of standard deflection and (2) erratic movement of the deviation indicator due to noise of not more than $\pm 5\%$ of standard deflection.

2.0 TEST PROCEDURES.

The test procedures set forth in 2.0 of this Appendix are satisfactory for use in determining the performance of airborne ILS localizer receiving equipment. Test Procedures which provide equivalent information may be used.

2.1 *Voltage Standing Wave Ratio (Receiver).* The test procedures set forth below are satisfactory for use in determining the performance of airborne ILS Localizer receiving equipment. Test procedures which provide equivalent information may be used.

a. *Equipment Required:*

RF Signal Generator (Boonton Model 211A or equivalent).

Slotted Line having an impedance equal to that for which the receiver input is designed.

An Impedance Bridge may be used in lieu of the slotted line.

b. *Measurement Procedure:*

(1) *Slotted Line Method:*

With the receiver operating and the slotted line connected to the receiver input, apply an RF signal to the input of the slotted line. Measure the minimum and maximum RF voltages along the slotted line and compute the VSWR.

The level of the input signal shall not be high enough to overload the receiver input circuit.

(2) *Impedance Bridge Method:*

With the impedance bridge, measure the impedance of the receiver input circuit and compute the VSWR.

The level of the signal shall not be high enough to overload the receiver input circuit.

2.2 *Voltage Standing Wave Ratio (Antenna):*

a. *Equipment Required:*

RF Signal Generator (Boonton Model 211A or equivalent).

Slotted Line having an impedance equal to that for which the antenna input is designed. An Impedance Bridge may be used in lieu of the slotted line.

b. *Measurement Procedure:*

(1) *Slotted Line Method:* Apply to the antenna input, through the slotted line, an RF signal. Measure the minimum and maximum RF voltages along the slotted line and compute the VSWR.

(2) *Impedance Bridge Method:* With the impedance bridge, measure the impedance of the antenna input circuit and compute the VSWR.

2.3 *Centering Characteristic:*

a. *Equipment Required:*

RF Signal Generator (Boonton Model 211A or equivalent)

AF Signal Generator (Military Type MD83 or equivalent)

Deviation indicator having an accuracy of $\pm 1\%$. A meter of equivalent resistance may be substituted for the deviation indicator.

b. *Measurement Procedure:* Apply to the receiver input a standard localizer centering signal. Vary the signal input level over the range of 40 to 20,000 μ v. Determine the maximum deviation of the indicator from its centered position.

2.4 *Sensitivity and Deflection Characteristic:*

a. *Equipment Required:*

RF Signal Generator (Boonton Model 211A or equivalent)

AF Signal Generator (Military Type MD83 or equivalent)

Deviation indicator having an accuracy of $\pm 1\%$. A meter of equivalent resistance may be substituted for the deviation indicator.

b. *Measurement Procedure:* Apply to the receiver input a standard localizer deviation signal. Determine the range of deviation indicator deflection when the level of the input signal is varied over the range of 40 to 20,000 μ v.

2.5 *Deflection Linearity*

a. *Equipment Required:*

RF Signal Generator (Boonton Model 211A or equivalent)

AF Signal Generator (Military Type MD83 or equivalent)

Deviation Indicator having an accuracy of $\pm 1\%$. A meter of equivalent resistance may be substituted for the deviation indicator.

b. *Measurement Procedure:* Apply to the receiver input a standard localizer test signal. Vary the difference in depth of modulation of the 90 and 150 c.p.s. signals over the range of 0 to 0.4 and determine the proportionality of the difference in depth of modulation to deviation indicator deflection up to maximum

deviation indicator deflection. For values of difference in depth of modulation beyond that producing maximum deviation indicator deflection, determine whether the deflection is less than its maximum value. This test shall be conducted at RF input signal levels of 40; 100; 200; 1,000; 10,000; and 20,000 μv .

2.6 Selectivity:

a. Equipment Required:

RF Signal Generator (Boonton Model 211A or equivalent)
Audio Signal Generator (Military Type MD83 or equivalent)
Output Power Meter (General Radio Model 583-A or equivalent)

- b. *Measurement Procedure:* Apply to the receiver input a radio-frequency signal of such a level that the receiver operates below the knee of the AVC characteristic and note the receiver output at center response frequency. Determine the frequencies on both sides of center response frequency to which the signal generator must be tuned to produce the output noted above when the level of the input signal is two times (6 db) and 1,000 times (60 db) the input required to produce the output noted above at the maximum response frequency.

2.7 Spurious Response:

a. Equipment Required:

RF Signal Generators (General Radio Model 805-C and Hewlett-Packard Models 608-A, 610-B and 614-A, or equivalent)
AF Signal Generator (Hewlett-Packard Model 200-B or equivalent)

- b. *Measurement Procedure:* Apply to the receiver input an RF signal modulated 30% at 150 c.p.s. and having a level 60 db greater than that producing 0.6 of standard deflection at center response frequency. Vary the radio-frequency of the input signal over the range from 0.190 mc. to 1,500 mc., excluding the band 107.8 mc. to 112.2 mc., and determine whether the indicator deflection exceeds 0.6 of standard deflection over this frequency range.

2.8 Cross Modulation:

a. Equipment Required:

2 RF Signal Generators (Boonton Model 211A or equivalent)
AF Signal Generator (Military Type MD83 or equivalent)
Combining Unit (See Figure 1)

b. Measurement Procedure:

- (1) Connect the two signal generators together by means of the combining unit. Apply, simultaneously, to the receiver input a standard localizer centering

signal having a level of 200 μv at maximum response frequency (desired signal) and a signal consisting of an RF carrier amplitude modulated 30% by 150 c.p.s. and having a level of 10,000 μv (undesired signal).

- (2) Vary the radio-frequency of the undesired signal over the range from 107.0 mc. to 112.0 mc., excluding the band from -200 kc. of maximum response frequency to +200 kc. of maximum response frequency. Determine the maximum amount of deflection of the deviation indicator from its centered position due to cross modulation.
- (3) Repeat this test with the level of the desired signal at 1,000 μv and the level of the undesired signal at 20,000 μv .

2.9 Alarm Signal:

a. Equipment Required:

RF Signal Generator (Boonton Model 211A or equivalent)
AF Signal Generator (Military Type MD83 or equivalent)
Deviation Indicator having an accuracy of $\pm 1\%$. A meter of equivalent resistance may be substituted for the deviation indicator.

- b. *Measurement Procedure:* Apply to the receiver input a standard localizer test signal having a level of 1,000 μv . Determine the position or response of the alarm signal under the following conditions:

- (1) When the 90 and 150 c.p.s. modulation is removed from the carrier.
- (2) When the modulation percentages of the 90 and 150 c.p.s. signals are 10% each.
- (3) When the level of the standard localizer deviation signal is that which produces 50% of standard deflection.
- (4) When the level of the standard localizer test signal is varied over the range from 40 μv to 20,000 μv .

2.10 Emission of Spurious Radio-Frequency Energy:

a. Equipment Required:

See Paragraph 1 and 2, Page 3 of Appendix A of RTCA Paper 120-61/DO-108.

b. Measurement Procedure:

See Paragraph 3, Page 5 of Appendix A of RTCA Paper 120/61/DO-108.

2.11 Damping Characteristic:

a. Equipment Required:

RF Signal Generator (Boonton Model 211A or equivalent)
AF Signal Generator (Military Type MD83 or equivalent)

- b. *Measurement Procedure:* Apply to the receiver input a standard localizer test signal of 1,000 μv . Abruptly change the signal

from a standard centering signal to a standard deviation signal and determine the time required for the deviation indicator needle to move from its centered position to the point which is removed from its final stabilized position by a distance equal to 10% of standard deflection. Determine the amount the deviation indicator needle overshoots its stabilized position.

2.12 Power Source Frequency Variations: This test applies to that equipment designed for operation from an a.c. power source of variable frequency.

a. Equipment Required:

RF Signal Generator (Boonton Model 211A or equivalent)

AF Signal Generator (Military Type MD83 or equivalent)

Deviation indicator having an accuracy of $\pm 1\%$. A meter of equivalent resistance may be substituted for the deviation indicator.

a.c. power source having a frequency range equal to at least that for which the equipment is designed.

- b. Measurement Procedure:** Apply to the receiver input a standard localizer centering signal having a level of 1,000 μv . Vary the frequency of the a.c. power source over the range for which the equipment is designed and determine the maximum change in deflection of the deviation indicator from its centered position.

2.13 Deviation Indicator Stability with Change in Frequency of 90 and 150 c.p.s. Signals:

a. Equipment Required:

RF Signal Generator (Boonton Model 211A or equivalent)

AF Signal Generator (Military Type MD83 or equivalent)

a.c. power supply whose frequency may be varied over the range of 58.5 to 61.5 c.p.s. Deviation indicator having an accuracy of $\pm 1\%$. A meter of equivalent resistance may be substituted for the deviation indicator.

b. Measurement Procedure:

- (1) Apply to the receiver input a standard localizer centering signal of 1,000 μv . Vary the frequency of the modulation signals simultaneously over the range from 97.5% to 102.5% of 90 and 150 c.p.s. Determine the maximum change in deviation indicator deflection from its centered position.
- (2) Apply to the receiver inputs a standard localizer deviation signal of 1,000 μv .

Vary the frequency of the modulation signals simultaneously over the range from 97.5% to 102.5% of 90 and 150 c.p.s. Determine the maximum change in deviation indicator deflection from standard deflection.

2.14 Deviation Indicator Sensitivity Adjustment Range:

a. Equipment Required:

RF Signal Generator (Boonton Model 211A or equivalent)

AF Signal Generator (Military Type MD83 or equivalent)

Deviation indicator having an accuracy of $\pm 1\%$. A meter of equivalent resistance may be substituted for the deviation indicator.

b. Measurement Procedure:

- (1) Apply to the receiver input a standard localizer deviation signal of 1,000 μv . Determine the deviation indicator deflection when the value of the component or components controlling deviation indicator sensitivity is varied over the range for which the equipment is designed.
- (2) Conduct the tests set forth in paragraphs 2.3, 2.4 and 2.5 with the deviation indicator sensitivity adjusted to the high and to the low limits set forth in paragraph 2.14.

2.15 Operation of Two Localizer Receivers from the Same Antenna. This test is applicable to those receivers designed to operate from an antenna which also supplies signals to another receiver.

a. Equipment Required:

RF Signal Generator (Boonton Model 211A or equivalent)

AF Signal Generator (Military Type MD83 or equivalent)

Deviation Indicator having an accuracy of $\pm 1\%$. A meter of equivalent resistance may be substituted for the deviation indicator.

b. Measurement Procedure: Connect the receivers to the antenna transmission lines in accordance with the manufacturer's instructions.

- (1) Apply at the junction of the two transmissions lines to the receiver inputs a standard localizer centering signal of 1,000 μv . Set the receiver under test to receive the standard localizer centering signal. Set the other receiver to all possible channel settings and determine the maximum change in deflection of the deviation indicator from its centered position. Repeat this test on each radio-frequency localizer channel for which the equipment is designed.

- (2) Conduct tests as required to determine whether the equipment meets all of the standards set forth in paragraph 2.0 For these tests, the receiver input shall be the junction of the two transmission lines connected to the receivers.

2.16 Audio-Frequency Response

a. Equipment Required:

RF Signal Generator (Boonton Model 211A or equivalent)
AF Signal Generator (Military Type MD83 or equivalent)
AF Signal Generator (Hewlett-Packard Model 200B or equivalent)

b. Measurement Procedure:

- (1) Apply to the receiver input a standard localizer audio signal modulated 1,000 c.p.s. Adjust the RF signal level and the receiver gain control (if provided) to produce a signal plus noise-to-noise ratio of at least 25 db and an output equal to at least 90% of rated output
- (2) Vary the frequency of the audio modulation signal from 200 to 6,000 c.p.s. Determine (a) the receiver output level at 350 and 2,500 c.p.s. and (b) the maximum and minimum receiver output levels over the range of 350 to 2,500 c.p.s.

2.17 Audio Output Regulation and Distortion

a. Equipment Required:

RF Signal Generator (Boonton Model 211A or equivalent)

AF Signal Generator (Hewlett-Packard Model 200B or equivalent)

Distortion and Noise Meter (General Radio Model 1932A or equivalent)

- b. *Measurement Procedure:* Apply to the receiver input a standard localizer audio signal of 1,000 μ v. Using a 1,000 c.p.s. audio modulation signal, determine the output and the distortion plus noise with receiver output load impedances of 50%, 100% and 200% of that for which the receiver is designed. Repeat the above test for audio modulation signals of 350, 500, 1,800 and 2,500 c.p.s. and for RF input levels of 40 and 20,000 μ v.

2.18 Percentage Modulation Characteristic

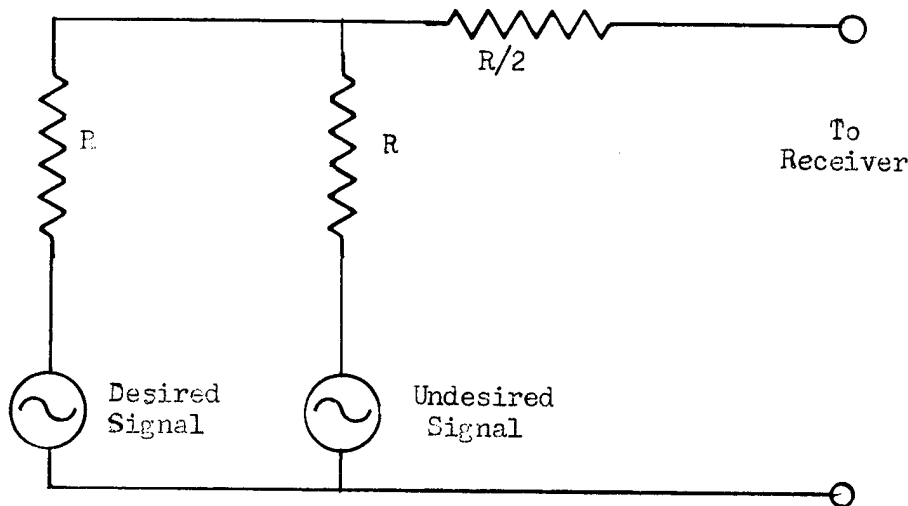
a. Equipment Required:

RF Signal Generator (Boonton Model 211A or equivalent)

AF Signal Generator (Military Type MD83 equivalent)

Deviation indicator having an accuracy of $\pm 1\%$. A meter of equivalent resistance may be substituted for the deviation indicator.

- b. *Measurement Procedure:* Apply to the receiver input a standard localizer centering signal of 1,000 μ v. Increase the percentage modulation produced by the 90 and 150 c.p.s. signals from 20% each to 25% each and determine the change in deviation indicator deflection.



R = Characteristic impedance of the transmission line for which the receiver is designed.

FIGURE 1—Combining Unit.